OVIPOSITION AND BEHAVIOR OF *LIRIOMYZA PUSILLA* (MEIGEN)

(Diptera: Agromyzidae)

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Among the normal fauna of *Baccharis pilularis* D. C. is a leaf-mining agromyzid that produces blotch mines. Mr. C. T. Greene was so kind as to identify the fly as *Liriomyza pusilla* (Meigen). A difference of opinion exists as to the identity of *pusilla*, inasmuch as A. E. Pritchard (personal communication) has pointed out that certain records in the literature refer to *pusilla* as a serpentine miner, while K. E. Frick (personal communication) states that certain European writers apparently limit the name *pusilla* to a blotch miner of euphorbia. It is clear that there is some confusion in the literature on this matter.

The mines of this fly may be found on *Baccharis* from March through June, but activity declines rapidly with the onset of dry weather and the attendant slowing up or cessation of growth. The larvae reappear in the fall after the rains begin. In general, the activity of the larvæ coincides with the period of growth of the plant.

It has been noted, as for instance by Needham, Frost and Tothill (Leaf-mining Insects, 1928, pp. 231-278) that leaf-mining Diptera are often far from host specific, and it is very probable that *Baccharis pilularis* is not the only host of *L. pusilla*. However, no other species was reared from *Baccharis*, so it appears that in the Peninsula district of the San Francisco Bay region, this is the usual agromyzid leaf-miner of *Baccharis*. The damage done is negligible, the percentage of infested leaves per plant being small.

Freshly emerged adults were confined over a branch of *Baccharis pilularis* subspecies *consanguinea* D. C. on March 24. On the afternoon of the same day, the female was observed running rapidly over the leaves, pausing at times to stroke the surface with the labella. After considerable examination, a spot was selected and the ovipositor inserted into the leaf. Peristalsis of the abdomen followed, and to all appearances oviposition was taking place. After each puncture had been completed, the female re-

treated a few steps and smoothed the puncture with the labella, also feeding on the exudate. This caused the punctures to be very inconspicuous. The entire process was repeated many times, but it became increasingly apparent that no eggs were being deposited. After several days of this behavior, the female was removed and the leaves minutely examined, and as suspected, no eggs had been laid in any of the punctures.

Concurrent with this experiment, a feral female taken on April 25 was similarly confined over a branch of the plant. The same behavior, consisting of inspection, puncture, and feeding on the puncture, was observed in this field-taken female, but it was easily evident that an egg was being laid in each puncture. On April 28 the leaves were examined and many eggs were found.

The egg is oval, somewhat pointed at each end, and inserted into the tissue of the leaf just below the epidermis and parallel to the leaf surface, not vertical to it. The egg lies about its own length from the entrance to the puncture and at a magnification of 30x is easily visible as a swelling below the epidermis. Fifty-seven eggs were found quite evenly distributed over the surface of seven large leaves, and were about equally numerous on both upper and lower surfaces. Only large leaves were used for oviposition. Numerous other punctures did not contain eggs.

The eggs increased in size after oviposition, and it is believed that this is due to imbibition of fluids from the plant tissues. Certain of them increased to fully twice the dimensions of freshly laid eggs. Some necrosis of the plant tissue resulted from the insertion of the ovipositor, but in every case this was slight. The hatching of the eggs was unfortunately not seen since no method was devised to prevent the leaves from wilting in the laboratory.

However, several field-collected larvae were reared. It was found that they fed as do certain other leaf-mining diptera, (such as Anthomyiidae), moving the anterior end of the body in a lateral horizontal plane, from side to side. This was accompanied by scraping movements by the mouth hooks, the mesophyll of the leaf being removed and ingested. The mines were linear and inconspicuous at first, but became blotchy later, and eventually involved most of the leaf surface. Although eggs were laid on both upper and lower surfaces of leaves, there was no differentiation into upper and lower surface mines, all becoming similar in appearance as the larvae matured.

The larvae are able to leave one leaf and to enter another. This is done when the larva reaches the end of a leaf, even when material remains uneaten in other parts. It cuts a crescent-shaped slit in the epidermis and squeezes out. It then crawls across the leaf-surface by alternately elongating and telescoping the body. The anterior end of the body is advanced and a hold obtained with the mouth hooks. Then the posterior part of the body is advanced by contracting the intersegmental membranes. The anal disc is also used in pushing forward. To enter a leaf, the larva cuts a small gash in the epidermis and begins to feed in the usual manner, gradually working its way in. The surface of the body is moist and viscid and it leaves a track of slimy deposit.

At maturity, the larva exits from the leaf by a crescent-shaped opening and wanders around for some time, as much as several hours. Most of the larvae that were observed entered soil to pupate, but some individuals pupated on leaves, stems, or on the sides of rearing vials. The puparium is yellowish-brown, with the segmentation of the larval skin distinctly visible. There are two prominent dorsal projections and two much less well marked lateral posterior projections. These are the tubes mentioned in descriptions. The puparia average 2.0 mm. in length.

The reason for lack of success in obtaining eggs from females reared in the laboratory is not entirely understood, but it is assumed to be due to a lack of certain essential foods that are available to females under field conditions. The situation may be similar to that existing in *Callophora,* as cited by Brues (Insect Dietary, 1946, pp. 59-60), in which certain protein foods must be available to the female, and in which, moreover, a certain length of time is required for the eggs to mature.

Two species of hymenopterous parasites were reared, both emerging from the puparia. One was a species of *Opius,* a member of a genus known to parasitize Agromyzidae. The other was a species of *Melanips* (Figitinae) of a group, the members of which are frequently hyper-parasites. It is likely that *Melanips* is secondary on *Liriomyza* through some primary parasite.

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